



# The Aeronautical Telecommunication Network: a Cooperative Venture

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*NASA Workshop on Integrated CNS Technologies*  
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*1-3 May 2001*

Mike Murphy

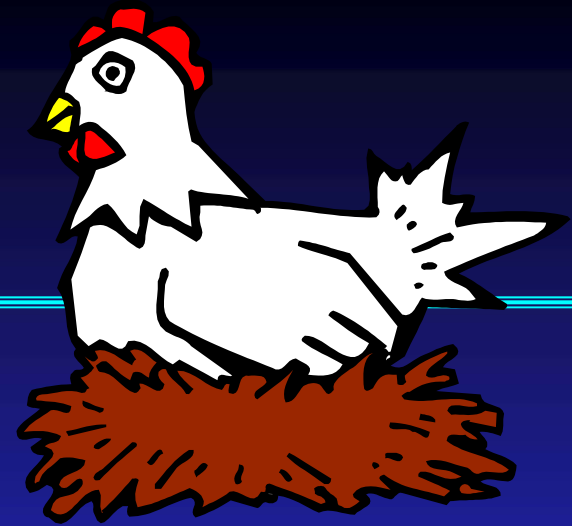
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# Data Link Implementation

## *Chicken vs. the Egg*

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### The Problems

### Solutions

Technology First  
- or -  
Applications First



**Program Commitments**  
(Technology and Applications)

Users Equip First  
- or -  
Providers Equip First



**Cooperative Development**  
(Users and Providers)

# ATNSI Consortium

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- Air Canada
- Alaska Airlines
- American Airlines
- American Trans Air
- Continental Airlines
- Delta Air Lines
- El Al Israel Airlines
- Federal Express
- Hawaiian Airlines
- Northwest Airlines
- Trans World Airlines
- United Airlines
- United Parcel Service
- US Airways

# ATNSI/FAA Cooperative Agreement

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## ■ Objective

- ◆ Provide Capacity and Efficiency Benefits to World-Wide Flight Operations



Develop the critical components of the Aeronautical Telecommunication Network (ATN) and encourage wide-spread deployment in the air and ground segments of the aviation community.

# ATN - What is it?

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- Aeronautical Telecommunication Network (ATN)
  - ◆ “Internet-like” network protocol approved by ICAO for Civil Aviation Authority (CAA) Air Traffic Data Communication Services - air/ground and ground/ground
  - ◆ Based on OSI standards (not TCP/IP)
  - ◆ Open System (Non-Proprietary)
  - ◆ Supports MOBILE Users
- Operates over ICAO-Compliant Subnetworks
  - ◆ SATCOM Data 3, VDL-2, etc.

# ATN Design Objectives

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- Extensive use of existing Networks
- High Integrity Data Transfer
- Mobile Systems Capability
- Prioritized Resource Management
- Scaleable
- Policy Based Routing
- COTS wherever practicable

COTS: Commercial Off-the-Shelf Software

# ATN Architecture (Air/Ground)

		Communication Service
A S E	<u>Application Service Element (ASE) Subsystem</u> CM/CPDLC/ADS-A/FIS	Dialog Service
R R I	<u>Upper Layers Subsystem</u> ACSE/Fast Byte COPP and COSP <u>Transport Subsystem</u> COTP <u>Internetworking/Routing Subsystem</u> CLNP/IS-SME/ES-IS/IDRP <u>Subnetwork Access Subsystem</u> Ground SNDCEF/Mobile SNDCEF/ISO 8208 (X.25)	Transport Service       Subnetwork Service

# ATN Certification Requirements

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## ■ Avionics End System

- ◆ Transport & Above (with address and data checksums)

- ☞ RTCA DO178B - development to “Level C” requirements

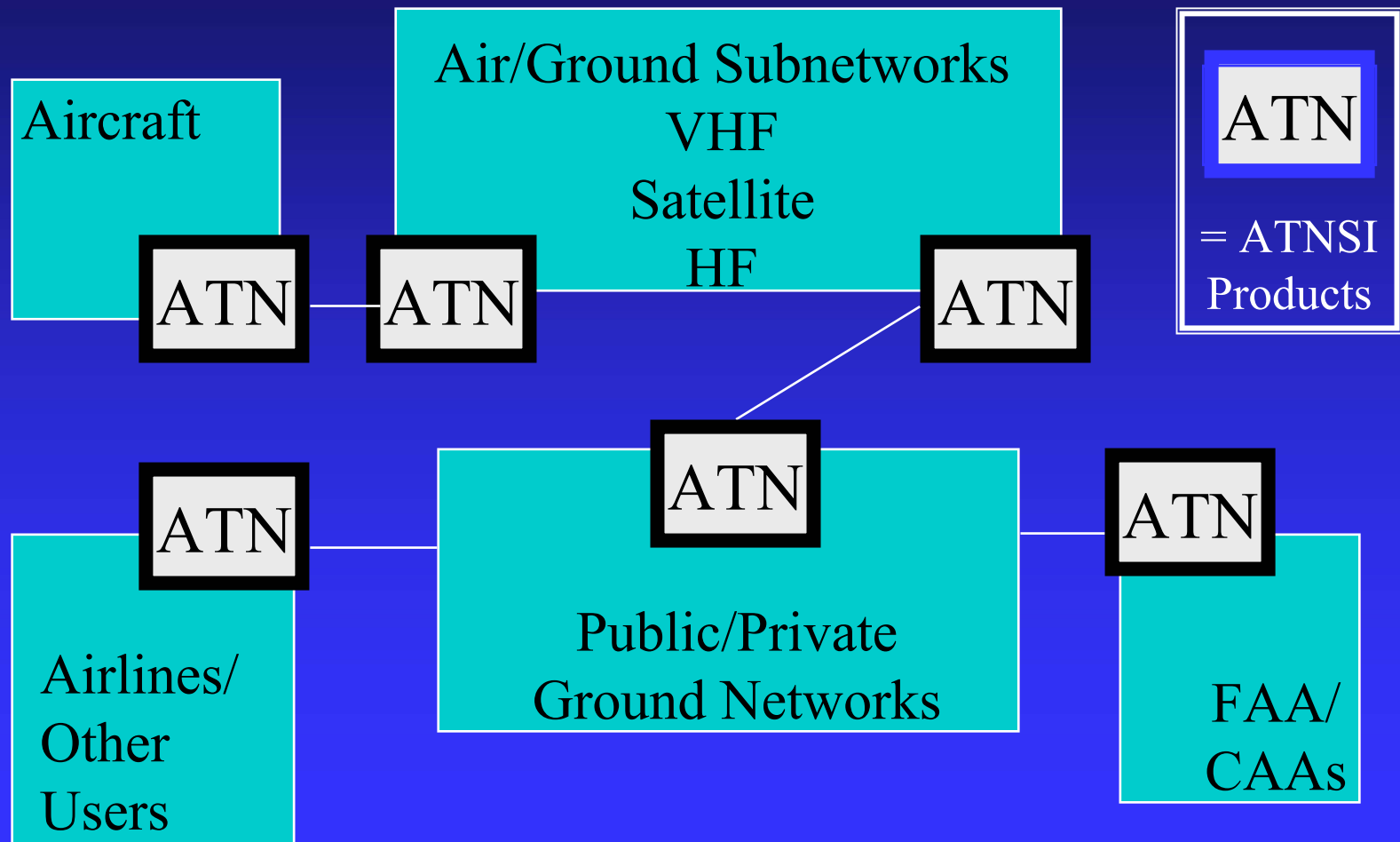
## ■ Routers and Ground End Systems

- ◆ (see RTCA Special Committee 194)

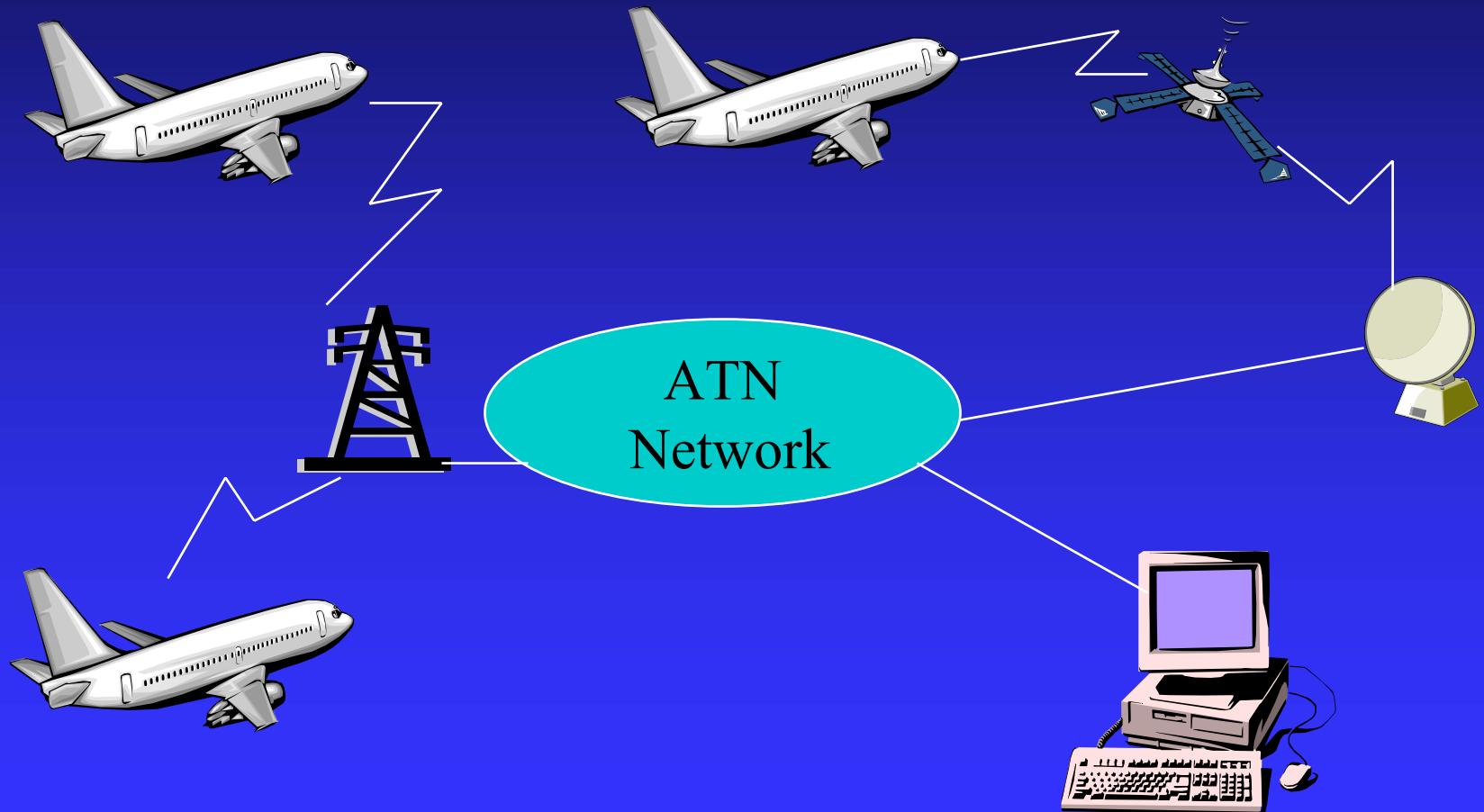
## ■ Certification Plan

- ◆ Requires ICAO Conformance (via RTCA MOPS)

# ATN Infrastructure Components



# Air/Ground ATN Implementation Status



# ATN Air/Ground Application Services

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## ■ Air Traffic Control (ATC) Services

- ◆ Controller Pilot Data Link Communications (CPDLC)
- ◆ Automatic Dependant Surveillance (ADS)
- ◆ Flight Information Services (FIS)
- ◆ Context Management (CMA)

## ■ Other Potential Services

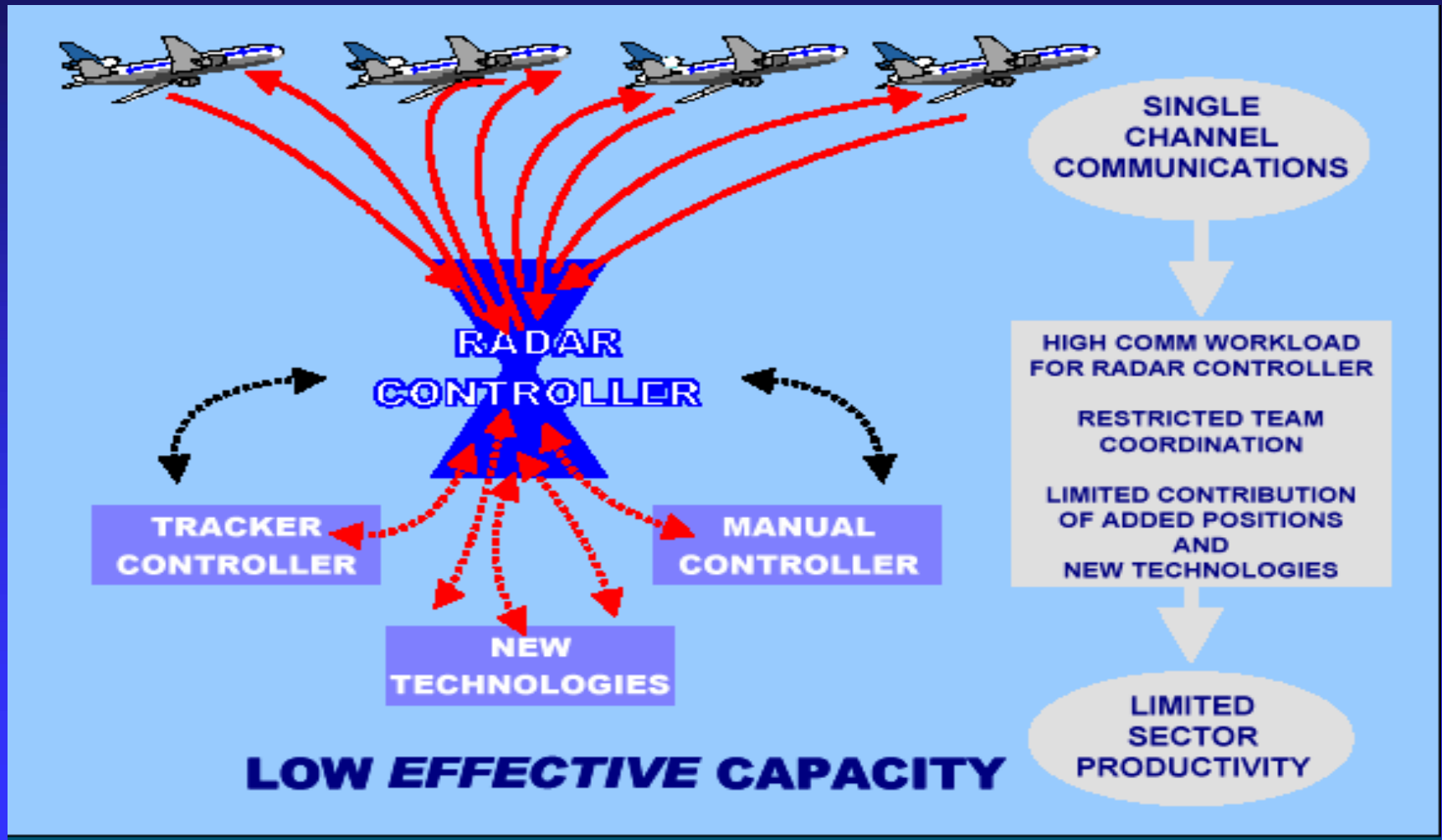
- ◆ Aeronautical Operational Control (AOC)
- ◆ Aeronautical Administrative Communication (AAC)
- ◆ Aeronautical Passenger Communications (APC)

# ATC Service Benefits

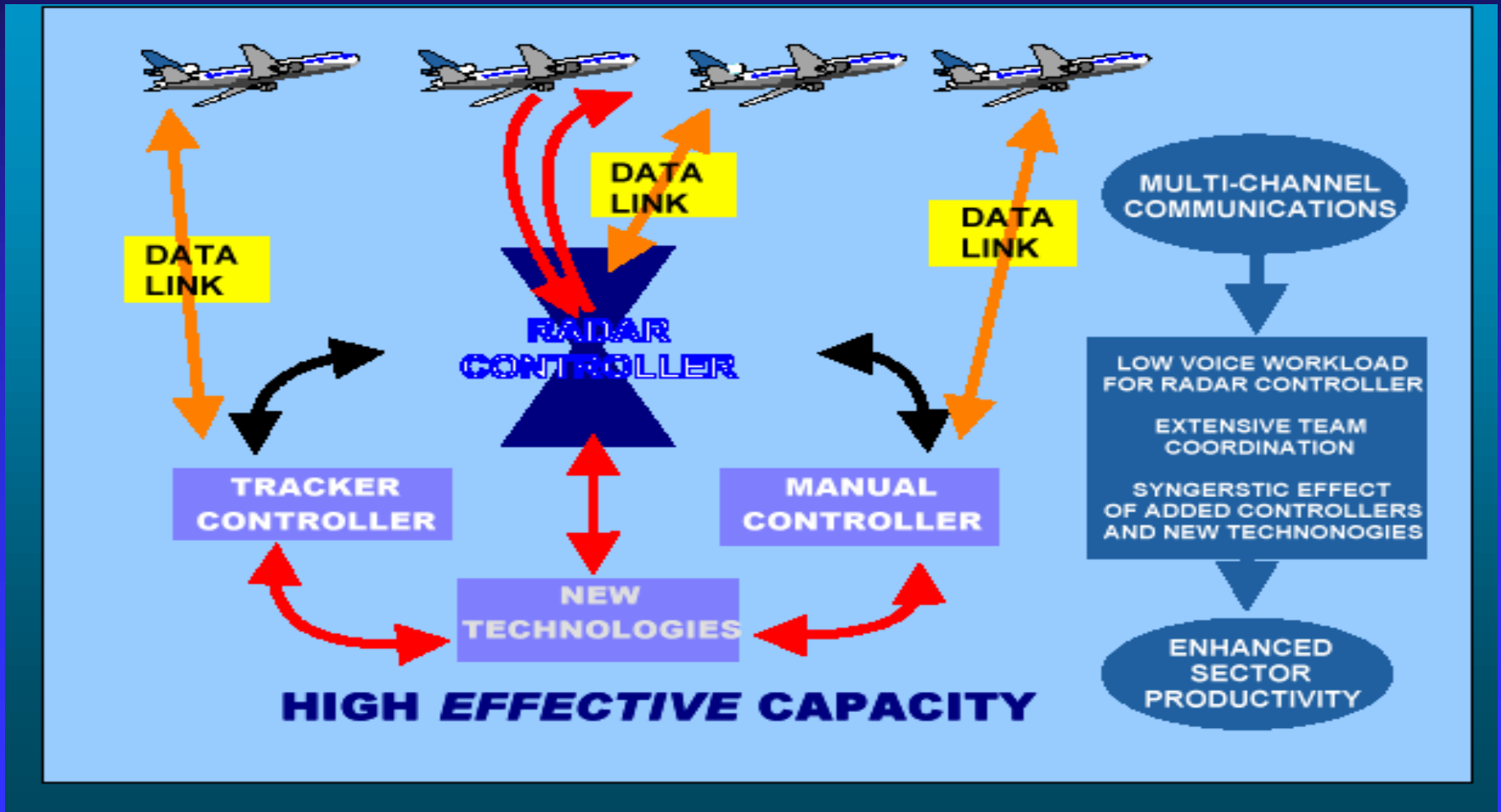
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- Reduced Holding and Delays
  - ◆ Enables Timely and Effective Clearances
- Reduced Communication Errors
  - ◆ Enables Utilization of pre-prepared Messages and facilitates Error Checking
- Increased Margin of Safety
  - ◆ Enables a more orderly Operation during Traffic Rushes

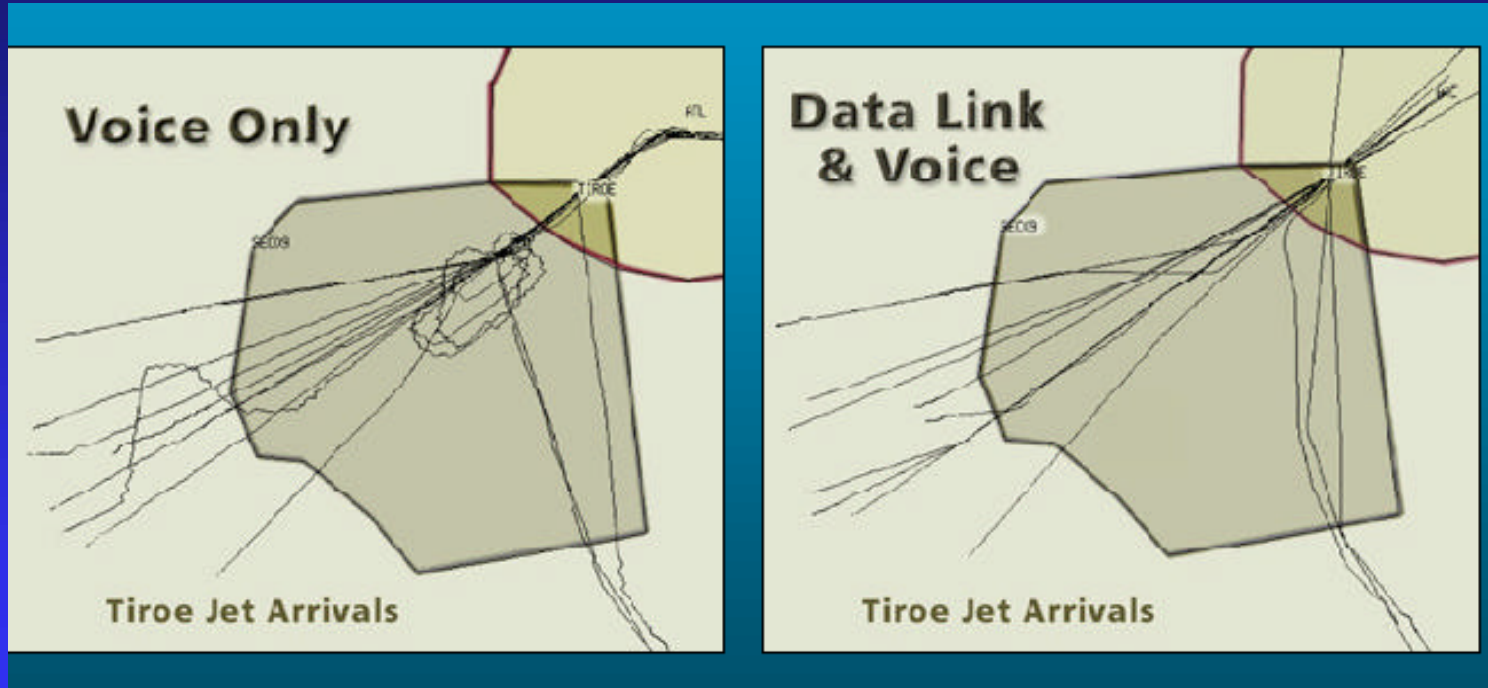
# Problem: Congested Voice Radio Sector



# Solution: Data Comm. + Voice Radio



# Example: FAA Study

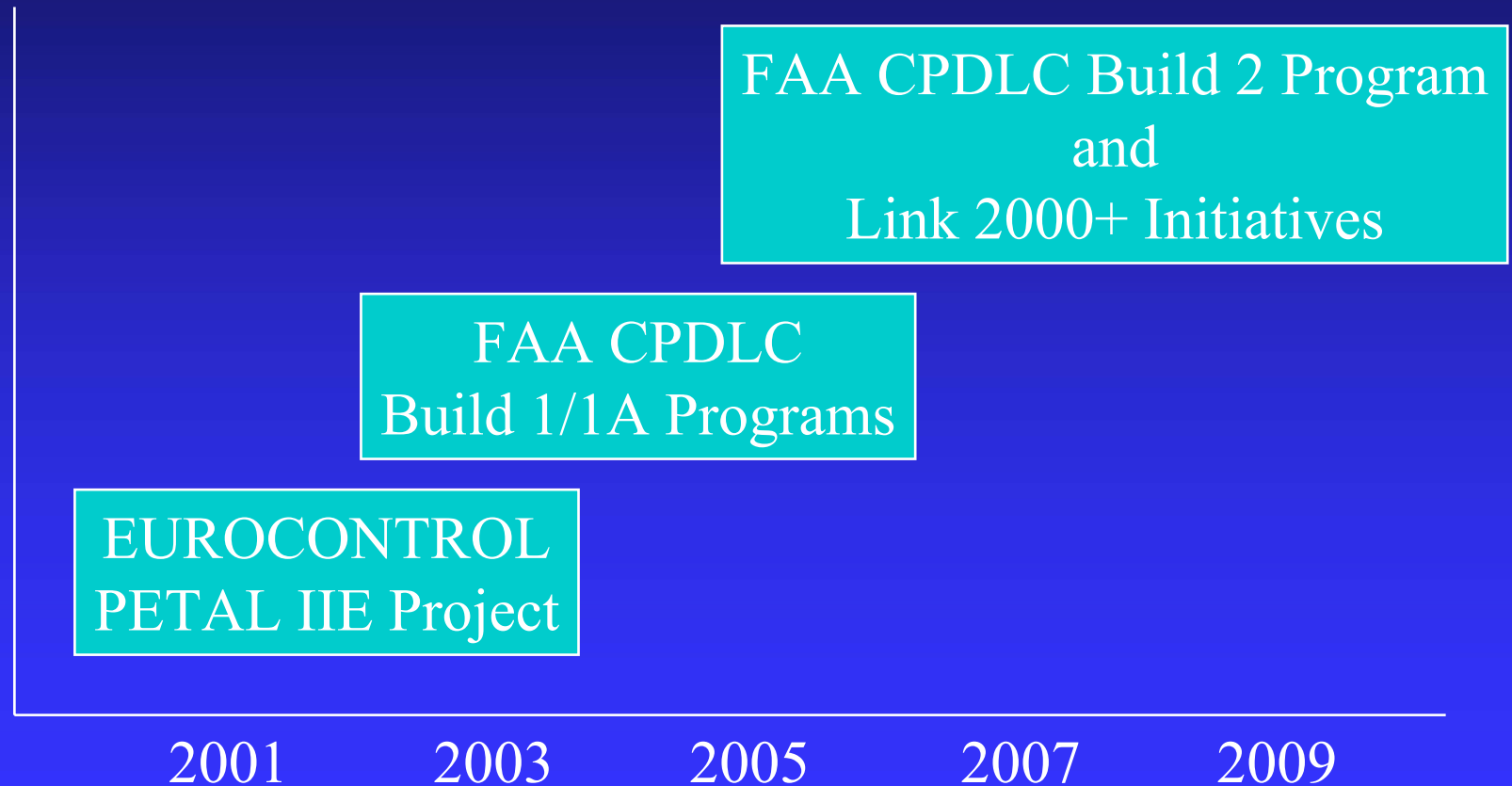


Problem

Solution

# Air/Ground ATN Implementation Programs

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# PETAL IIE Project Overview

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- PETAL = Preliminary Eurocontrol Test of Air/Ground Data Link
  - ◆ PETAL IIE = Extension of PETAL Project to include ATN Operations
- Single Site: Maastricht Upper Area Control Centre
- Operational Services
  - ◆ Transfer of Voice Communication, Initial Contact, Altimeter Setting
  - ◆ Clearances and Requests: Flight Level, Route and Heading, Speed
  - ◆ “Passive” Requests (e.g. Preferred Level, Top of Descent)
- Uses VDL Mode 2 as Air/Ground Subnetwork
- American Airlines is the Launch Airline

[www.eurocontrol.be/projects/eatchip/petal2/](http://www.eurocontrol.be/projects/eatchip/petal2/)

# PETAL IIE Overview

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Status:

- End-to-End Testing in Progress
- Flights Start in June 2001

# FAA CPDLC Build 1 Overview

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- Single Site: Miami Air Route Traffic Control Center
- Provides 4 Operational Services
  - ◆ Transfer of Voice Communication
  - ◆ Initial Contact
  - ◆ Altimeter Setting
  - ◆ Informational Free Text (menu capability built by supervisor inputs)
- Uses VDL Mode 2 as Air/Ground Subnetwork
- American Airlines is the Launch Airline

[www.adl.tc.faa.gov](http://www.adl.tc.faa.gov)

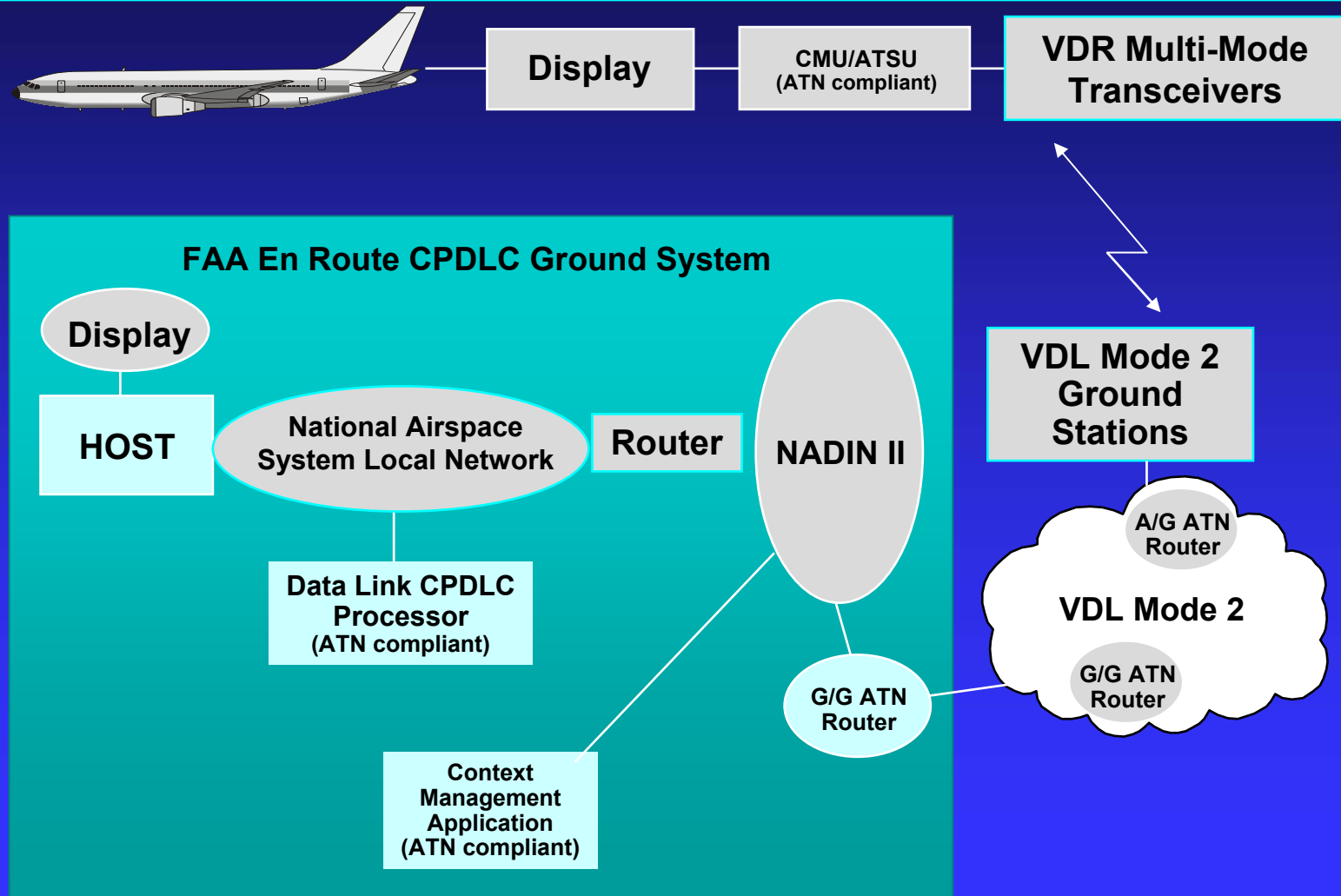
# FAA CPDLC Build 1A Overview

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- National Deployment: All Air Route Traffic Control Centers
- Provides Additional Operational Services
  - ◆ Larger Message Set accommodating assignment of Speeds, Headings, and Altitudes
  - ◆ Includes Route Clearance Function
  - ◆ Capability to accommodate Pilot-Initiated Altitude Requests
- Uses VDL Mode 2 as Air/Ground Subnetwork
- American Airlines is the Launch Airline
- Widespread Industry Participation is Anticipated

[www.adl.tc.faa.gov](http://www.adl.tc.faa.gov)

# FAA CPDLC Build 1/1A Architecture



# Next Steps: R&D

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- Application-Driven Bandwidth Requirements
- Network Management/Security
- Integrated Architectures

# Application-Driven Bandwidth Requirements

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- Applications

- ◆ Next Generation (Air Traffic, Wx, etc.) Requirements

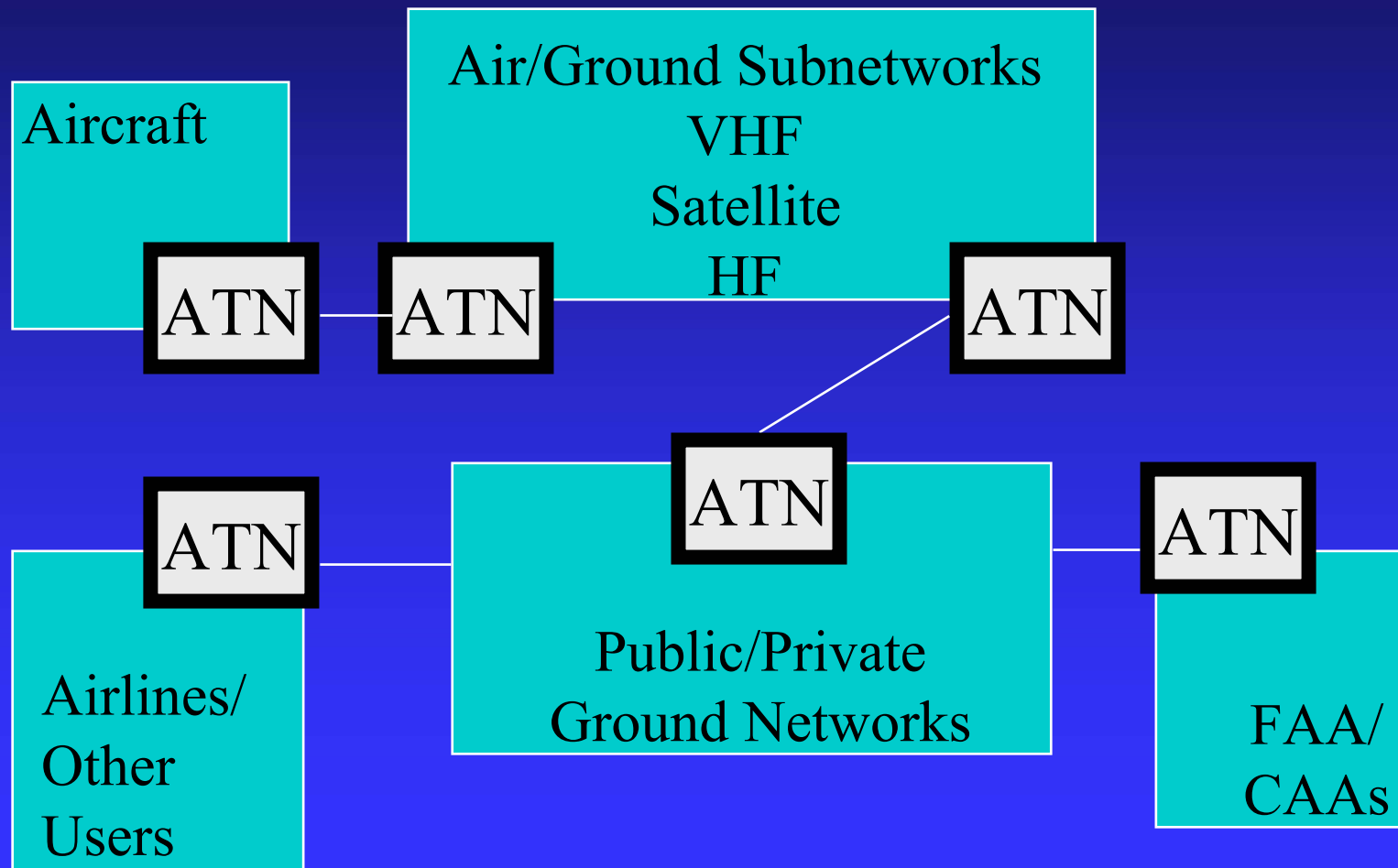
- Subnetwork Capabilities

- ◆ Bandwidth Requirements

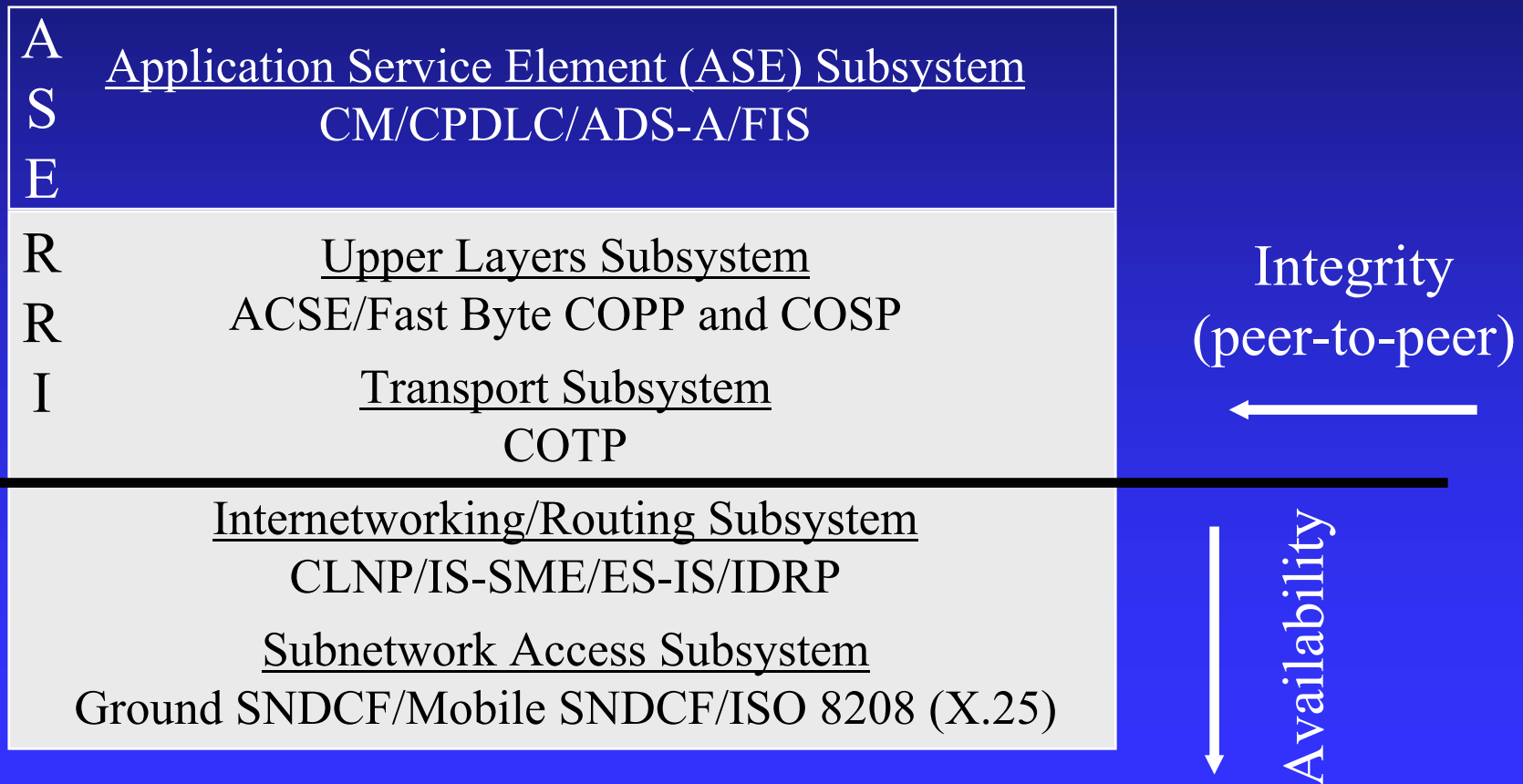
- Required Communication Performance

- ◆ Integrity, Availability, Latency Requirements

# Network Management/Security



# Integrated Architectures





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